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(19) (CA) **CANADIAN PATENT** (12)

(54) Header for a Harvesting Machine

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HEADER FOR A HARVESTING MACHINE

ABSTRACT OF THE DISCLOSURE

10      A flexible header for a combine or swather includes a pair of wing sections which can flex relative to a central section. Each wing section carries a draper canvas for transporting cut crop inwardly toward the central section. Beneath the inner ends of the drapers is mounted a further draper for transporting the crop rearwardly through an opening in the central frame into the feeder housing of the combine. Above the central draper is mounted a roller member having a central paddle portion and auger portions outside of the central portion for confining and directing the crop in cooperation with the central draper into the feeder housing. The pivot axis of each wing portion is inclined inwardly and forwardly so that the axes intersect at the sickle knife. This arrangement allows the manufacture of a large width flexible combine header.

HEADER FOR A HARVESTING MACHINEBACKGROUND OF THE INVENTION

10 This invention relates to a header for a harvesting machine of the type which can be moved in a working direction across a field including a standing crop to be harvested. Such devices can in some cases be used to directly combine the crop so that it is cut and passed into a combine body in which the grain is separated from the straw and chaff. In other arrangements the header can be used on a swather or windrower in which the crop is first cut and laid out by the machine into a swath or windrow for subsequent pickup by a combine.

20 Headers for combines have in recent years almost exclusively used as a feed mechanism for transporting the cut crop inwardly to an opening in the combine feeder housing an auger screw arrangement which is arranged rearwardly of the conventional sickle knife along a front edge of the header. These auger screw arrangements have become universal due to the simplicity of manufacture and due to the effective feeding of the high rates of material harvested by modern machines. It will be appreciated that the rate of movement of the machine across the ground and therefore the rate of cut-

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ting of crop has significantly increased over recent years and the auger screw has been found to accommodate such high rates of feeding. In addition the auger screw properly feeds the material into the feeder housing of the combine without causing undue shelling or loss of grain.

10 There is a requirement in modern machines to yet further increase the working width of the machine so that one pass of a large machine with a wide cutting blade cuts a wider swath of crop and thus reduces the number of passes. This has a number of advantages including reduced fuel usage, less damage to the ground by passes of heavy machinery and reduced working hours to complete the harvesting.

In practice, therefore, the maximum width of a header of this type is of the order of 30 feet and attempts to go beyond this width have met with very little success.

20 It is one object of the present invention, therefore, to provide an improved header device for a harvesting machine which provides an improved feed mechanism for transporting the cut crop along the header to the discharge opening to the combine.

According to a first aspect of the invention,

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therefore, there is provided a header for a crop harvesting machine comprising a frame, means for mounting the frame on the machine for transportation in a working direction across a field including a standing crop to be harvested, a knife arrangement extending transversely across a front edge of the frame for cutting the standing crop, means defining an opening rearwardly of the frame through which the cut crop is guided to pass, the frame extending outwardly therefrom to respective sides thereof, a first and a second draper assembly each including a pair of draper guide rollers arranged with the respective axes of rotation extending generally parallel to the working direction, one of said rollers being spaced from the opening to a respective side thereof and the other of said rollers being arranged adjacent said opening to define end of the draper assembly, and a draper canvas arranged rearwardly of said knife arrangement so as to receive the cut crop therefrom and constrained by the rollers to move transversely of the frame towards said end to carry said cut crop toward said opening, a third draper assembly including a pair of draper guide rollers arranged with respective axes extending transversely to said working direction and a draper canvas arranged rearwardly of said knife arrangement and at said ends of the

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first and second draper assemblies so as to carry said cut crop rearwardly of the frame from said ends to said opening to pass therethrough, a confining and feeding member, and means mounting said confining and feeding member in spaced position above a rear end of said third draper assembly so as to cooperate with said third draper assembly to confine said cut crop and to direct said cut crop to pass through said opening.

10            Preferably the confining and feeding member comprises a rotatable member which has a central section including a plurality of flexible paddle members which extend outwardly from the roller and lie in angularly spaced axial planes so that the paddles act to feed the material through the opening into the feeder housing. On either side of the central section defined by the paddle members, there can be provided a short auger section of a length significantly less than the length of the portion of the frame extending outwardly to one side from the opening so that substantially the whole of the transportation of the crop along the frame from outer portions thereof toward the opening is carried out by the draper canvas with the third draper canvas and the roller member acting to confine the member into the feeder housing.

20            Preferably the forward roller of the third

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draper is positioned with its outside ends beneath the innermost rollers of the first and second drapers. To accommodate this and to maintain the lowest possible angle of the first and second drapers, the forward roller of the third draper is positioned rearwardly of the knife and spaced therefrom. The angle of the third draper to the horizontal is less than side to side angle of the first and second drapers so that a gap of increasing width is formed between the end of the first and second drapers and the upper surface of the third draper.

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According to a second aspect of the invention, there is provided a header for a crop harvesting machine comprising a frame, means for mounting the frame on the machine for transportation in a working direction across a field including a standing crop to be harvested, a knife arrangement extending transversely across a front edge of the frame for cutting the standing crop, means defining an opening rearwardly of the frame through which the cut crop is guided to pass, the frame extending outwardly therefrom to respective sides thereof, a first and a second draper assembly each including a pair of draper guide rollers arranged with the respective axes of rotation extending generally parallel to the working direction, one of said rollers being spaced from the opening

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to a respective side thereof and the other of said rollers being arranged adjacent said opening to define end of the draper assembly, and a draper canvas arranged rearwardly of said knife arrangement so as to receive the cut crop therefrom and constrained by the rollers to move transversely of the frame towards said end to carry said cut crop toward said opening, a third draper assembly including a pair of draper guide rollers arranged with respective axes extending transversely to said working direction and a draper canvas arranged rearwardly of said knife arrangement and at said ends of the first and second draper assemblies so as to carry said cut crop rearwardly of the frame from said ends to said opening to pass therethrough, an elongate confining and feeding member having a longitudinal axis transverse to said working direction and extending from a first end spaced inwardly from an outer end of said first draper canvas and a second end spaced inwardly from an outer end of said second draper canvas, means mounting said confining and feeding member in spaced position above a rear end of said third draper assembly and means driving said confining and feeding member to rotate about said axis in a direction to feed material thereunder so as to cooperate with said third draper assembly to confine said cut crop

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and to direct said cut crop between an underside of said confining and feeding member and an upper surface of said rear end of said third draper canvas to pass through said opening.

With the foregoing in view, and other advantages as will become apparent to those skilled in the art to which this invention relates as this specification proceeds, the invention is herein described by reference to the accompanying drawings forming a part hereof, which includes a description of the best mode known to the applicant and of the preferred typical embodiment of the principles of the present invention, in which:

DESCRIPTION OF THE DRAWINGS

Figure 1 is a top plan view of a combine harvester including a header according to the present invention.

Figure 2 is a top plan view of a central portion of the header of Figure 1 on an enlarged scale.

Figure 3 is a rear elevational view of the portion of the header of Figure 2.

Figure 4 is a cross sectional view along the lines 4-4 of Figure 1.

Figure 5 is a cross sectional view along the lines 5-5 of Figure 1.

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In the drawings like characters of reference indicate corresponding parts in the different figures.

DETAILED DESCRIPTION

10 In Figure 1 a combine harvester is indicated generally at 10 and comprises a body 11 mounted on ground wheels 12 and 13 which are of conventional construction with the body including a conventional arrangement of beaters, sieves and the like for separating grain from straw and chaff. The body is fed by a feeder housing 14 which again is of conventional construction and in a conventional machine is built separately from a header indicated at 15 so that the combine 10 can be used with different types of header as required by a particular customer.

Thus the feeder housing 14 includes a front flange 16 to which a central frame portion 17 of the header 15 can be attached simply by suitable bolt or clamp arrangements.

20 The header comprises the central frame portion 17 and a pair of wing frame portions 19 and 20 which extend respectively out to sides of the combine and are pivotally coupled relative to the central frame portion 17. A sickle knife arrangement 21 is mounted across a front edge of the wing frame portions to present a for-

wardmost cutting member for engaging and cutting the crop in conventional manner. Each of the wing frame portions 19 and 20 carries a draper assembly 22, 23 which is arranged immediately rearwardly of the sickle knife and movable to carry the cut crop along the wing portion transversely of the direction of motion toward the feeder housing 14. A further draper assembly 24 is positioned at the central frame portion and moves in a direction to transport the material from the ends of the drapers 22 and 23 rearwardly into the feeder housing 14 through an opening therein of conventional construction.

Turning now to Figures 2 and 3, the construction of the header at the central frame is shown on larger scale and in more detail. The frame 17 comprises a transverse upper beam 171, a pair of vertical beams 172, 173 and a transverse lower beam 174 thus defining therebetween an opening 175 through which material to be fed can pass to the feeder housing 14 of the combine. The opening 175 is designed to be larger than the intended opening in the feeder housing 14 so that it can accommodate different sizes of combine. The coupling between the frame 17 and the feeder housing can include an additional attachment frame arrangement (not shown) which can be specifically tailored to accommodate different types

of combine so that the single header can be modified by the attachment frame mechanism for attachment to various different manufactured combines which are already existing.

10 The draper assembly 24 comprises a pair of rollers 241, 242 with the axes of the rollers arranged transverse to the working direction of the header so that a draper canvas 243 carried by the rollers has an upper run which moves rearwardly toward the opening 175. The roller 242 is mounted on the central frame 17 and the roller 241 has each end mounted loosely on a respective one of the wing frames 19 and 20. The roller 241 is arranged spaced rearwardly of the sickle knife arrangement 21 and particularly rearwardly of the bar 211 which supports the sickle knife and is of conventional construction.

20 The central frame 17 also carries a roller member 25 which is omitted from the illustration of Figure 1 for convenience but is shown clearly in Figures 2, 3 and 4. The roller member 25 comprises the shaft 251 which is rotatably mounted in bearings 252 carried by the frame 17 on suitable supports. The shaft 251 has at a central section thereof extending over only a part of the length thereof a paddle section defined by a pair of

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flexible paddle members 253 which are mounted in an axial plane of the shaft 251 and are spaced angularly by 180°. Outwardly of the paddle section is arranged a pair of auger screw flights 254, 255 which are angled so as to cause an inward movement on rotation of the shaft 251 in an anticlockwise direction as viewed in Figure 4 so that it will be appreciated therefore that the roller member 25 and the draper 24 cooperate in their rotation to tend to feed material rearwardly from the central frame portion 18 through the opening 175 into the feeder housing 14 of the combine. In particular, the paddle blades 253 act at the very centre of the opening to bat or paddle the material rearwardly thus tending to confine it toward the draper 24 so that it can properly pass through the opening in the feeder housing, which as previously explained is generally smaller than the opening 175 in the frame.

The auger sections 254 and 255 tend to move material toward the paddle section so as again to confine the material and direct it inwardly and downwardly for cooperation with the draper 24 through the opening into the feeder housing.

Each of the wing frame sections 20 and 21 comprises an upper frame member 201 and a lower tubular

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frame member 202 which extend outwardly from the central frame to a remote outer end of the wing frame section. The frame members are interconnected by a rear sheet 203 shown best in Figure 5 but omitted for convenience from Figure 3. The lower member 202 carries a lower channel structure section 204 which extends forwardly from the lower tube and carries the sickle knife bar 211. At the centre of the wing frame portions, there are provided frame members for supporting the ends of the roller 241 and for connecting to the plate 28.

The lower tube 202 and the structure 204 are attached to a bracket 208 which is right-angle shaped and includes a pair of end flanges 209 attached to a pair of bearings 210 for pivotal movement of the wing portion. The bearings 210 are carried upon a shaft 211 which is supported on the lower beam 174 of the frame 17. The pin 211 is angled forwardly and inwardly at approximately 45°. As shown in Figures 1 and 2 in plan, the pivot axes 212 of each of the wing sections therefore intersect on the mid line of the header approximately at the sickle knife arrangement 21.

The upper member 201 as shown in Figure 3 is attached by a spring 216 to the transverse upper strut 171. The biasing force of the spring 216 acts to lift

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the tube 201 inwardly to hold the weight of the wing section against a downward pivoting movement of the end of the wing section about the pivot axis 212.

Adjacent the outer end of each of the wing sections is mounted a gauge wheel 26. The spring 216 is arranged to have sufficient spring force so that only a small proportion of the weight of the wing section rests upon the gauge wheel 26 so that the gauge wheel can run over the ground and can readily raise and lower the wing section in dependence upon the height of the ground relative to the central frame 17. Stop mechanisms (not shown) are provided on or around the spring 216 so as to limit the angle of movement of the wing section about the axis 212 to an angle of the order  $7^\circ$  which is sufficient over a length of a header of 45 feet to provide better control of the height of the header relative to the ground than a rigid unpivotable header does at a length of 30 feet. However, the angle is sufficiently small that it does not seriously interfere with the arrangement of the sickle knife or the reel as explained herein-after.

A front coupling between the wing sections is provided by a flex plate 28 which is bolted by bolts 29 to the innermost edge of the structure 204 of the wing

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sections at a position rearward of the sickle knife bar 211. The bolts are arranged, as shown, in a triangular arrangement outside of the pivot axis so that each of the wing sections is rigidly attached to the plate while a central area of the plate can accommodate the flexing movement necessary to provide the angle of pivot of the wing sections about the pivot axis 212.

At the centre, the sickle guards are mounted on the plate 28 which is aligned with the guard mounting bars 211. The plate 28 flexes about a large radius so as not to interfere with the cutting action.

Each of the wing sections carries a pair of rollers 30 and 31 with the rollers 31 positioned at an innermost end of the wing sections and the rollers 30 at an outermost end for receiving and moving a draper canvas 22, 23. The draper canvas is positioned immediately rearward of the bar 211 so that any cut crop drops from the knife directly onto the canvas for moving in parallel fashion transversely along the frame toward the draper 24.

As best shown in Figure 4, the roller 31 is positioned immediately rearwardly of and mounted upon the bar 211 and extends rearwardly therefrom to a rear edge of the wing section adjacent the lower tube 174. The



angle of the upper surface of the draper 23 is of the order of 18° relative to the intended ground direction or horizontal which is a sufficiently small angle to allow the crop to fall properly onto the draper and be carried thereby in parallel aligned relationship. A significantly increased angle of the draper tends to reduce the effectiveness of the transport of the crop so that it can bunch up and plug the machine by failure to remain in the proper parallel orientation. In addition it will be noted from Figures 4 and 5 that the draper is positioned at its forward end as close to the ground as possible and immediately rearward of the bar 211 so that there is very little or no step behind the sickle knife before the crop falls onto the draper. Thus with the sickle knife closely adjacent the ground indicated at 32, the forwardmost edge of the lower run almost contacts the ground and is spaced therefrom solely by the thickness of the pan extending beneath the draper.

The forward roller 241 of the draper 24 is spaced rearwardly from the bar 211 by a sufficient distance that it can extend beneath the lower run of the drapers 22 and 23 and specifically beneath the innermost rollers 31 thereof. Such a distance may be of the order of 9 inches to 18 inches and provides a condition in

10 which the outer edges of the draper 24 lie underneath the lower run of the drapers 22 and 23. This prevents material from wrapping the drapers 22 and 23 and jamming between the drapers 22, 23 and the draper 24. Furthermore this jamming is inhibited by the fact that the angle of the draper 24 to the horizontal is slightly less than the angle of the drapers 22 and 23 so that the gap between the upper run of the draper 24 and the lower run of the drapers 22 and 23 gradually increases as it approaches the opening 175. In addition the spacing between the front roller 241 of the draper 24 and the bar 211 provides a sufficient area to receive the flex plate 28.

20 The sickle knife 21 is generally of conventional construction and may provide an overlapped section between two sickle knife drive bars at the centre line of the header. Such an arrangement is clearly described and claimed in co-pending Canadian Application No. 496,789 filed on December 3, 1985 corresponding to U.S. Application No. 806,472 filed on December 9, 1985 and assigned to the assignee to the present application. The flexing which occurs at the plate 28 is insufficient to interfere with the movement of the sickle knife drive bar and can be accommodated by the sickle knife support bar 211.

A The reel generally indicated at 34 is omitted

from Figures 1, 2 and 3 for convenience of illustration but is shown in Figures 4 and 5. The reel includes a support shaft 35 on which is mounted a plurality of bats (not shown) by suitable support fins.

The reel is formed in two portions each of which extends from a centre line of the header outwardly to a respective end of a wing portion. At the centre line of the header is mounted a first reel support arm 36 which carries the shaft 35 on a suitable bracket arrangement 37 which is not shown in detail as this is of conventional construction. The reel arm 36 acts to support both portions of the reel at the centre position with the bats of the portions being slightly spaced to clear the support arm 36. It will be appreciated that, as the shaft 35 is positioned substantially directly above the sickle knife and thus the intersection of the pivot axes 212, the reels also can pivot about an axis longitudinal of the reel arm 36 which is effectively directly above the central pivot axis defined at the intersection of the pivot axes 212. Thus, because the wings 19 and 20 are effectively rigid and pivot about the axis 212 which intersect at the knife support 211, the reel can be manufactured in only two portions which pivot at the centre and still maintain uniform distance between the reel axis

and the sickle knife over the length of the wing. At the outer ends of the header is provided a further reel arm (not shown) which supports the outer end of the reel portion and which includes a lost motion connection so that the outer end of the reel can move in and out relative to the outer end of the wing portion to accommodate the vertical spacing between the axis of pivot of the reel and the axis of pivot of the header.

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Since various modifications can be made in my invention as hereinabove described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

CLAIMS

(1) A header for a crop harvesting machine comprising a frame, means for mounting the frame on the machine for transportation in a working direction across a field including a standing crop to be harvested, a knife arrangement extending transversely across a front edge of the frame for cutting the standing crop, means defining an opening rearwardly of the frame through which the cut crop is guided to pass, the frame extending outwardly therefrom to respective sides thereof, a first and a second draper assembly each including a pair of draper guide rollers arranged with the respective axes of rotation extending generally parallel to the working direction, one of said rollers being spaced from the opening to a respective side thereof and the other of said rollers being arranged adjacent said opening to define end of the draper assembly, and a draper canvas arranged rearwardly of said knife arrangement so as to receive the cut crop therefrom and constrained by the rollers to move transversely of the frame towards said end to carry said cut crop toward said opening, a third draper assembly including a pair of draper guide rollers arranged with respective axes extending transversely to said working direction and a draper canvas arranged rearwardly of said

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knife arrangement and at said ends of the first and second draper assemblies so as to carry said cut crop rearwardly of the frame from said ends to said opening to pass therethrough, a confining and feeding member, and means mounting said confining and feeding member in spaced position above a rear end of said third draper assembly so as to cooperate with said third draper assembly to confine said cut crop and to direct said cut crop to pass through said opening.

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(2) The invention according to Claim 1 wherein said confining and feeding member comprises an elongate member having a longitudinal axis transverse to said working direction and wherein there is provided means driving said confining and feeding member to rotate about said longitudinal axis in a direction to feed material thereunder.

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(3) The invention according to Claim 2 wherein said confining and feeding member comprises a roller having feed members extending outwardly from an exterior surface thereof for engaging and directing said crop through said opening.

(4) The invention according to Claim 3 when the feed members are flexible.

(5) The invention according to Claim 3 where-

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in the feed members comprise paddles each lying in an axial plane of said roller with the feed members being spaced angularly of said roller.

(6) The invention according to Claim 2 wherein said confining and feeding member includes auger flight means on an exterior surface thereof for rotation therewith and arranged relative to the direction of rotation of the member to generate a movement of said crop inwardly towards said opening and parallel to said first and second draper assemblies.

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(7) The invention according to Claim 1, 2 or 6 wherein said confining and feeding member has a first end spaced inwardly from an outer end of said first draper canvas and a second end spaced inwardly from an outer end of said second draper canvas.

(8) The invention according to Claim 2 wherein said confining and feeding member includes a plurality of paddle members on a section thereof adjacent said opening and a pair of auger flight means on respective ends thereof, the auger flight means being arranged relative to the direction of rotation of said member so as to cause a movement in said crop inwardly towards said opening.

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(9) The invention according to Claim 1 where-

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in said third draper assembly has side edges arranged such that each side edge thereof lies beneath a respective end of said first and second draper assemblies.

(10) The invention according to Claim 9 wherein the spacing between a respective side edge of the third draper canvas and the end of a respective one of the first and second draper assemblies increases in a direction from said knife arrangement toward said opening.

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(11) The invention according to Claim 9 or 10 wherein the first and second draper canvasses each have a side edge arranged substantially immediately rearwardly of said knife arrangement and wherein a forward one of said rollers of said third draper assembly is positioned rearwardly of said knife arrangement by a sufficient distance that the roller can extend beneath the end rollers of said first and second draper assemblies.

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(12) A header for a crop harvesting machine comprising a frame, means for mounting the frame on the machine for transportation in a working direction across a field including a standing crop to be harvested, a knife arrangement extending transversely across a front edge of the frame for cutting the standing crop, means defining an opening rearwardly of the frame through which



the cut crop is guided to pass, the frame extending outwardly therefrom to respective sides thereof, a first and a second draper assembly each including a pair of draper guide rollers arranged with the respective axes of rotation extending generally parallel to the working direction, one of said rollers being spaced from the opening to a respective side thereof and the other of said rollers being arranged adjacent said opening to define end of the draper assembly, and a draper canvas arranged rearwardly of said knife arrangement so as to receive the cut crop therefrom and constrained by the rollers to move transversely of the frame towards said end to carry said cut crop toward said opening, a third draper assembly including a pair of draper guide rollers arranged with respective axes extending transversely to said working direction and a draper canvas arranged rearwardly of said knife arrangement and at said ends of the first and second draper assemblies so as to carry said cut crop rearwardly of the frame from said ends to said opening to pass therethrough, an elongate confining and feeding member having a longitudinal axis transverse to said working direction and extending from a first end spaced inwardly from an outer end of said first draper canvas and a second end spaced inwardly from an outer end of

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said second draper canvas, means mounting said confining and feeding member in spaced position above a rear end of said third draper assembly and means driving said confining and feeding member to rotate about said axis in a direction to feed material thereunder so as to cooperate with said third draper assembly to confine said cut crop and to direct said cut crop between an underside of said confining and feeding member and an upper surface of said rear end of said third draper canvas to pass through said opening.

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(13) The invention according to Claim 12 wherein said confining and feeding member comprises a roller having feed members extending outwardly from an exterior surface thereof for engaging and directing said crop through said opening.

(14) The invention according to Claim 13 when the feed members are flexible.

(15) The invention according to Claim 13 wherein the feed members comprise paddles each lying in an axial plane of said roller with the feed members being spaced angularly of said roller.

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(16) The invention according to Claim 12 wherein said confining and feeding member includes auger flight means on an exterior surface thereof for rotation

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therewith and arranged relative to the direction of rotation of the member to generate a movement of said crop inwardly towards said opening and parallel to said first and second draper assemblies.

10 (17) The invention according to Claim 12 wherein said confining and feeding member includes a plurality of paddle members on a section thereof adjacent said opening and a pair of auger flight means on respective ends thereof, the auger flight means being arranged relative to the direction of rotation of said member so as to cause a movement in said crop inwardly towards said opening.

(18) The invention according to Claim 12 wherein said third draper assembly has side edges arranged such that each side edge thereof lies beneath a respective end of said first and second draper assemblies.

20 (19) The invention according to Claim 18 wherein the spacing between a respective side edge of the third draper canvas and the end of a respective one of the first and second draper assemblies increases in a direction from said knife arrangement toward said opening.

(20) The invention according to Claim 18 or 19

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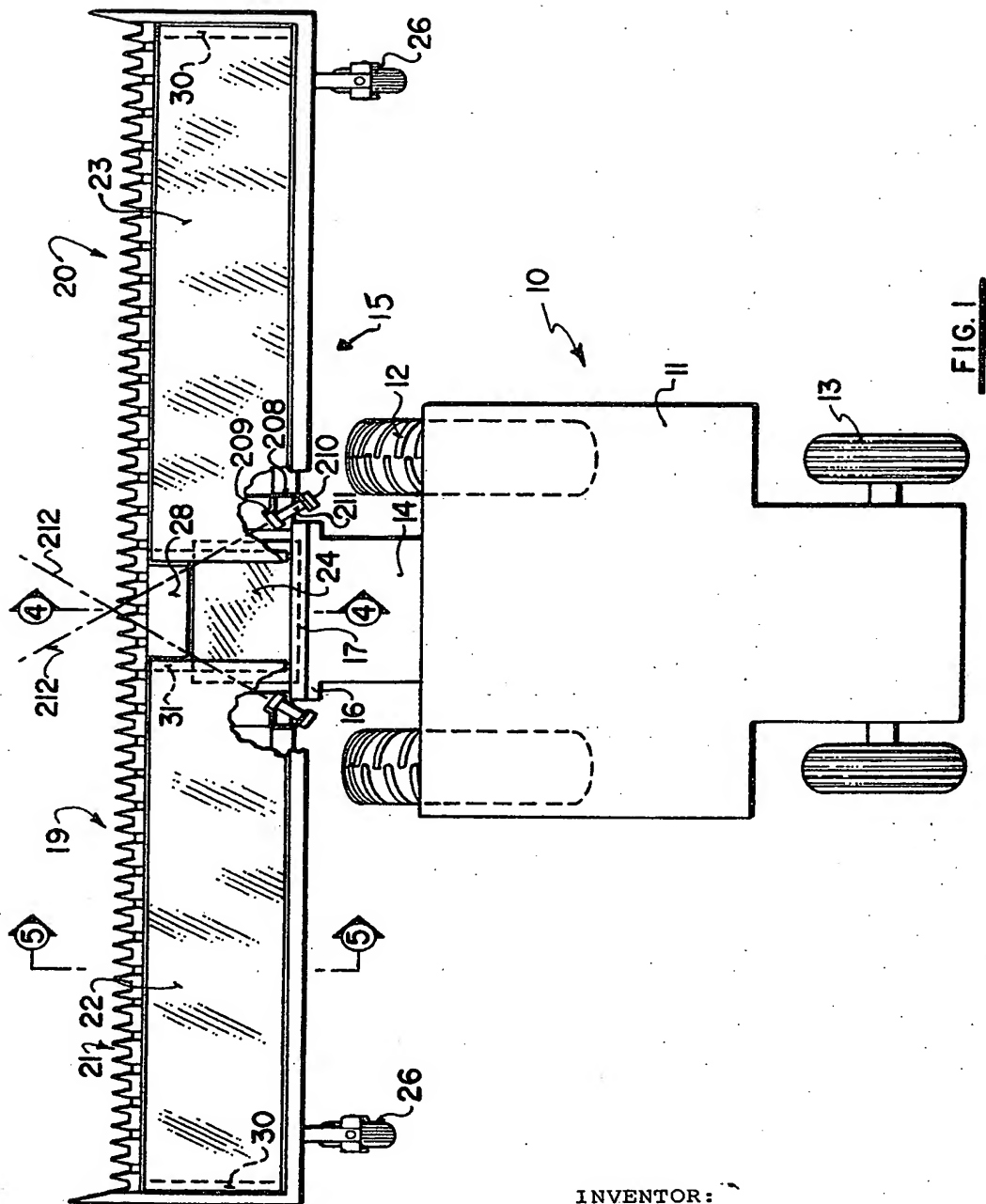
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wherein the first and second draper canvasses each have aside edge arranged substantially immediately rearwardly of said knife arrangement and wherein a forward one of said rollers of said third draper assembly is positioned rearwardly of said knife arrangement by a sufficient distance that the roller can extend beneath the end rollers of said first and second draper assemblies.

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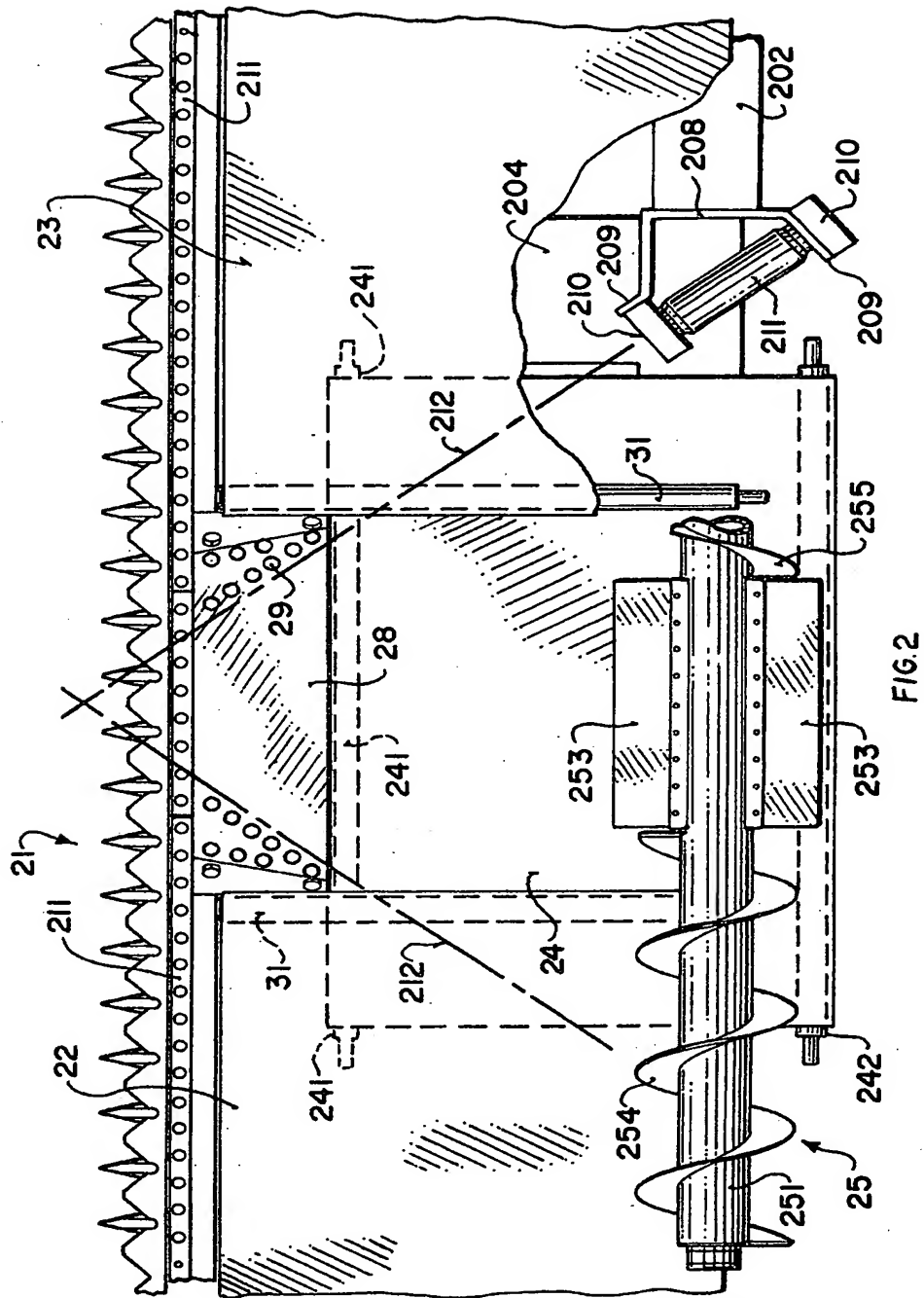




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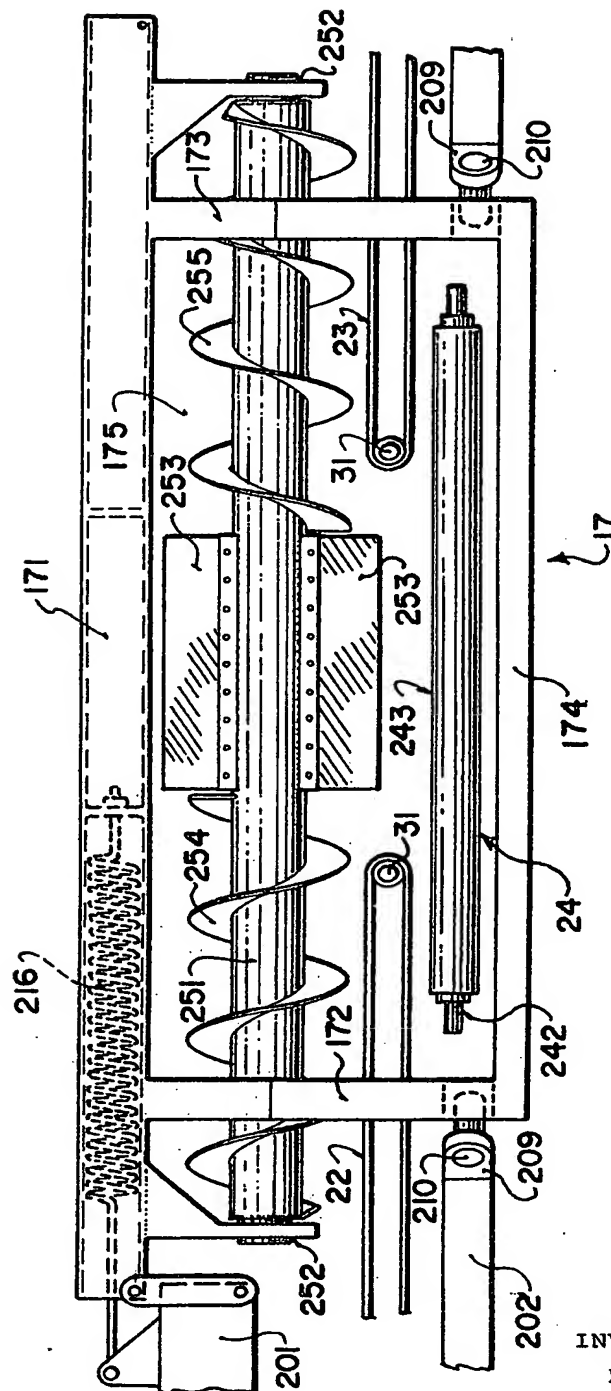
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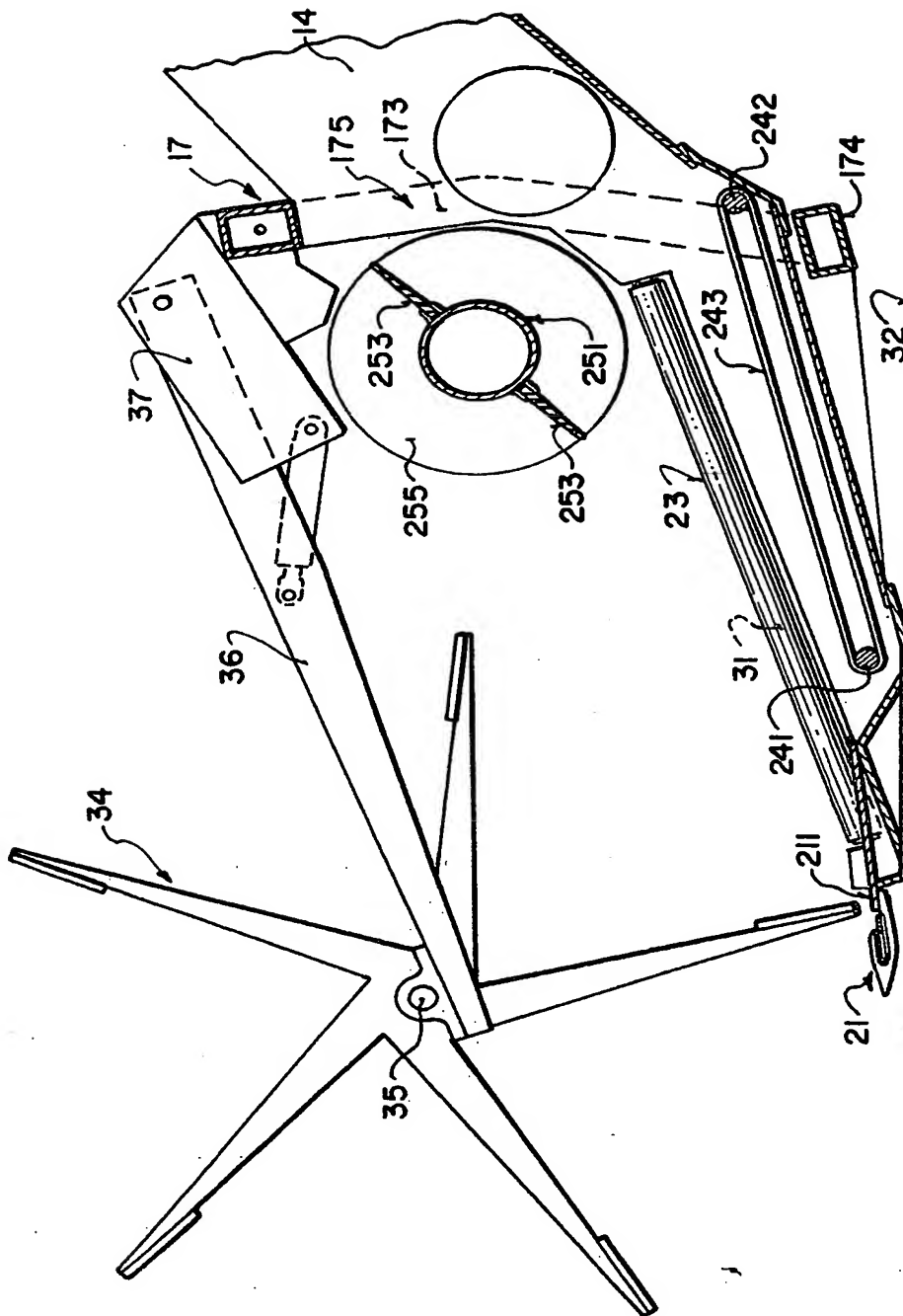


FIG. 4

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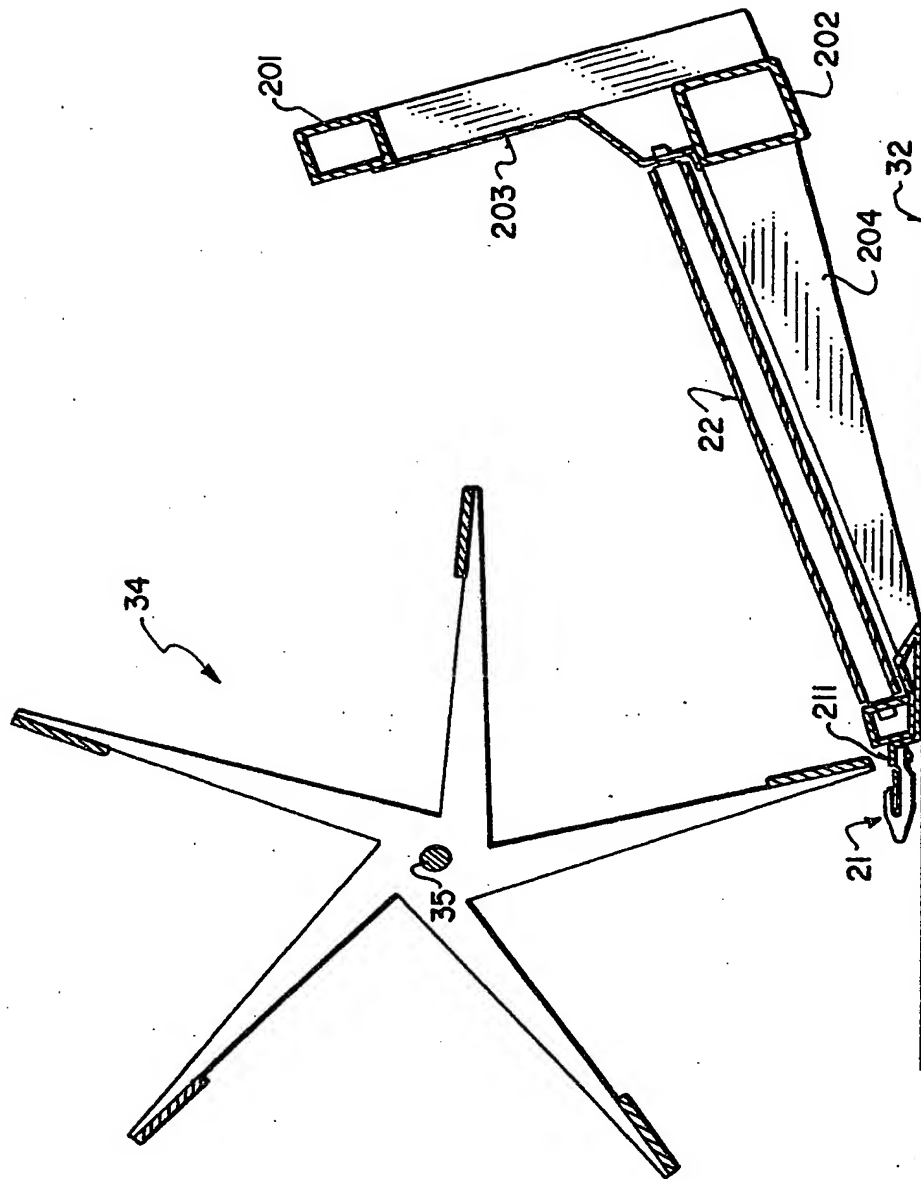


FIG. 5

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